

New York June 24<sup>th</sup> 1858.

Dear Sir

Your favor of the 18<sup>th</sup> inst was duly rec<sup>d</sup>, and I am obliged to you for the information contained therein. The results obtained are fully equal to my expectations, in view of the large amount of sweep you had on hand and the rapidity with which you have been obliged to work it. I shall be happy to hear the result of the next trial, and hope that it will prove satisfactory to you as well as to myself.

I enclose with this a circular, which was designed for popular distribution among gold-miners. You will observe that I have referred to the apparatus introduced into the Mint, and hope that it will meet with your approval. I have sent a copy to the Director, with a note accompanying it.

Give my regards to Mrs Booth. I congratulate you upon the birth of your little daughter, and hope that they will continue to improve in health.

Yours very truly

Edward W. Hunt

Prof. Jas. C. Booth  
U. S. Mint  
Phil<sup>a</sup>.



KENT'S PATENT  
APPARATUS FOR SEPARATING GOLD.

Patented in the United States, Great Britain, France and Belgium.

SHORTLY after entering upon my official duties as Melter and Refiner in the United States Assay Office, it was my ambition to discover a more effectual method for separating gold and silver from foreign substances than any which had been hitherto employed. Having an abundant and constant supply of material, I had facilities for effecting this object, which enabled me to investigate the subject in the most thorough and practical manner. The result of this investigation was the invention of the apparatus herein described, the first of which has been constantly in use at the United States Assay Office in New-York, since August 1st, 1855. One of them has been subsequently introduced into the United States Mint at Philadelphia, where it has been in daily use since April 1st, 1856.

The most striking peculiarity of this invention is, that so large a proportion of the gold can be separated by specific gravity alone. During the first six months of its use 9,333.66 ounces of gold and silver were separated by it, and of this large amount, 9,110.66 ounces (which is 97.6 per cent. of the whole) were obtained from the "Separator," which is that portion of the apparatus in which the separation is effected by *specific gravity* in a high column of water, without the use of mercury. The specific gravity of quartz is  $2\frac{1}{2}$ , iron pyrites 5, and of gold nearly 20. The finest particles of the precious metal are, therefore, nearly eight times heavier than those of quartz, and four times heavier than those of iron pyrites. Consequently when these, or other earthy substances containing gold, are suspended in a high column of water, the gold, which is the heaviest, falls to the bottom, and with a gentle current of water passing through the apparatus, the earthy substances, which are lighter, and the sulphurets, when re-crushed sufficiently fine, are carried away, and the gold remains.

Although gold is nearly twenty times heavier than water, it will sometimes float upon the latter, and is then called "floating gold." This is due to a repulsion of the fine particles of gold and water, which temporarily overcomes the law of specific gravity; but it occurs *only* when the gold is *dry* on the surface. If a needle be wiped dry and placed lightly on the surface of water, this also will float, and become a "floating needle;" but let the fine particles of gold, or the needle, *become once wet*, they will each obey the law of specific gravity, and fall to the bottom.

The principles involved in the action of the "Gold Separator" are based upon the theory described above. The ore (which has been previously crushed as fine as possible) is first *agitated with water*, by feeding it into the hopper or "Grain Separator," in which the gold which has been liberated by the previous crushing, is separated and retained. The earthy portion of the crushed ore is carried thence into the *centre* of the column of water in the submerged Chilian mill, in such a manner as to prevent the finest particles from floating upon the surface of the water, in which, as in the case above mentioned, the gold is separated and falls to the bottom, in obedience to the law of specific gravity. The heavier particles of earth or ore, *which are those containing gold*, also fall to the bottom of the mill, by virtue of their specific gravity, where they are ground under the water in which the finer portion is suspended by the agitation of the wheels, the gold falling to and remaining at the bottom, while the earth is carried away by the current of water; and as daily practical operation *has proved*, nearly 98 per cent. of all the gold is thus saved by specific gravity alone, and without the use of mercury, by the "Gold Separator" above described.

The principles involved in the action of the "Amalgamator" are based upon the following theory: It is well known that gold, *when clean*, readily amalgamates with mercury; but if the particles of gold, or the surface of the mercury, are dirty, there is a repulsion of the particles similar to that above mentioned, in the case of floating gold, and consequently dirty gold, *such as is found in all native ores*,



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and particularly in auriferous pyrites, cannot be entirely separated by amalgamation alone. Every gold miner will bear evidence to this. But dirty gold is nearly as heavy as clean gold, and consequently it can be separated by *specific gravity* upon the principles above mentioned; and when the particles of gold thus separated, and the surface of the mercury, are both cleaned, as in this apparatus, by the double action of wooden paddle wheels, the final separation of the gold may then be effected by amalgamation.

It is also well known to gold miners, that when the mercury used for amalgamation is broken up, or divided into small globules, these cannot be made to re-unite when dirty; and consequently a large quantity of mercury as well as gold is lost, in most of the amalgamators heretofore invented. With the apparatus herein described, this is not the case. The mercury is not agitated or broken up by stirring, and the high column of water above it prevents it from being carried away by the sand, consequently the mercury is saved in the same manner as in the separation or saving of gold by specific gravity. After six months daily and constant use of this amalgamator, no diminution of the quantity of mercury originally used was observed; and by carefully re-washing five barrels of tailings which had previously passed through it, only a trace of mercury was obtained.

It will be observed, that the earthy substance or crushed ore, when *once* supplied to this apparatus, is subjected to *three separate distinct and successive operations*, all of which are based on scientific principles, and applied to the metallurgy of gold in the following manner:

1. The crushed ore is first supplied to the hopper or grain separator, in which it is agitated with water, and subjected to an operation which very nearly resembles hand washing or panning, which is familiar to all gold miners, but it is much more perfect than hand washing, and instead of being performed by hand, is effected by the aid of machinery, so as to avoid manual labor, and perform a much larger amount of work. By this operation *alone*, all the gold that can be saved by hand washing or "panning," is separated at once, without abrasion or loss.

2. The earthy portion, from which all the gold which can be separated by panning, is now removed, passes into the centre of the column of water in the submerged Chilean mill, where it is re-crushed under water, so as to liberate the *finer* particles of gold from the earth, and the whole being suspended in the high column of water, by the agitation of the wheels, the earthy portion passes off when ground sufficiently fine, while the gold falls to the bottom of the mill, by virtue of its greater specific gravity, and is saved in the form of very rich or highly concentrated ore, from which the gold may then be profitably separated by smelting.

3. The fine earth which passes from the mill is again suspended in another column of water, and the *finest* particles of dirty gold which are thus separated by specific gravity, are cleaned by the double action of the paddle wheels, and then collected by amalgamation with the mercury, which is also cleaned at the same time, in such a manner as to prevent loss of mercury or the gold.

This apparatus is not heavy enough for *crushing quartz*, and was not designed for that purpose. But it is particularly adapted for separating gold from the *sulphurets*, and this is the portion usually lost by the use of other apparatus. For these reasons, the crude ore should be previously crushed as fine as possible, by larger and more powerful apparatus; then concentrated in such a manner as to leave the sulphurets and wash away the quartz. The *sulphurets* which retain the precious metal are then to be supplied to *this apparatus for separating the gold*. By this process a large amount of ore or tailings may be worked daily, because the bulk of the rich sulphurets is small, compared with that of the quartz. If, therefore, twenty tons of the powdered ore, or tailings from other apparatus, contain but one or two tons of *sulphurets*, the gold from twenty tons of it may be daily saved by this invention.

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